WORLDS OLDEST EXTANT McNAUGHT BEAM ENGINE

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Summary: In 1955, over 100 years after its date of manufacture in 1854 by A & W Smith & Co of Paisley near Glasgow, this McNaught Beam Engine was removed from Risby Bros Timber Mill & Factory in Collins Street, Hobart. In September 1990, it was placed on display at the Hobart Institute of TAFE and in 1997 it was awarded an Historic Engineering Marker.

This paper describes the Engineering Details of the Engine and the steps leading up to the claim of being the Worlds Oldest Extant McNaught Beam Engine.

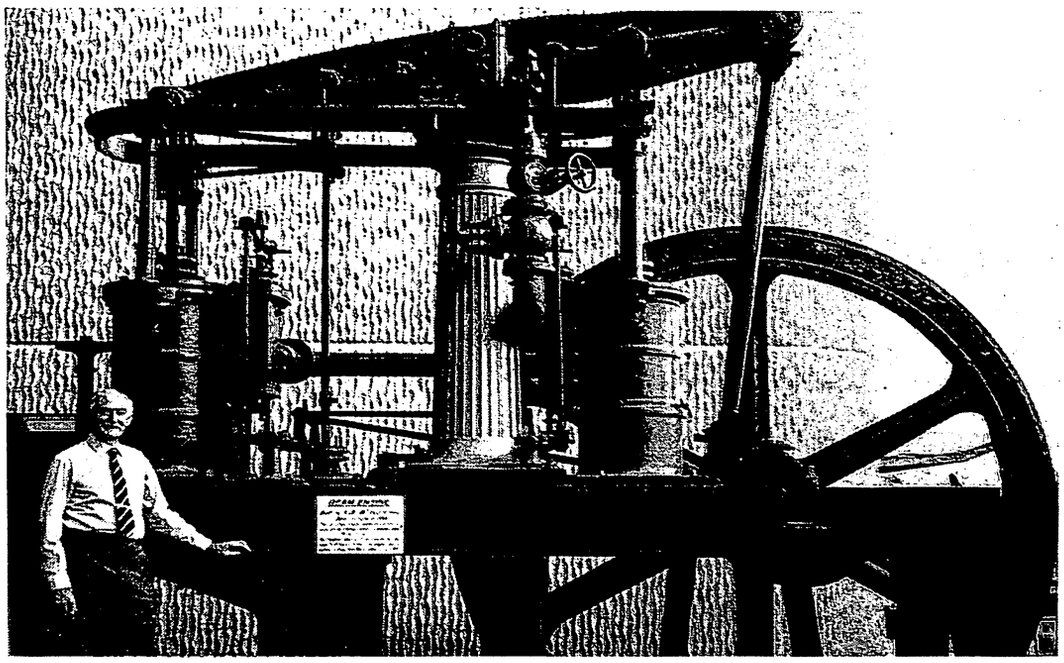

Figure 1: General View of A & W Smith & Co's McNaught Beam Engine Built in 1854

1. INTRODUCTION

In 1955, following a fire in the Boiler House and Engine Shed at Risby Bros Timber Mill in Collins Street, Hobart, where the Beam Engine was used to drive saw benches and dressing machines, the owners of the engine decided to replace it with a 100 h.p. electric motor and donate the engine to the Government on the understanding that it would be preserved and hopefully housed in an appropriate Technological Museum.

The engine was removed and re-assembled in the workshops of the Public Works Department (later to be named the Department of Main Roads) and stood in the open for the ensuing 35 years, fortunately it was periodically turned over by compressed air from the workshop supply.

In September 1990, it was refurbished and placed on display at the Hobart Institute of TAFE.

2. EARLY HISTORY OF THE ENGINE

Little is known as to exactly when the engine arrived in the Colony, the first evidence came from the original records of Boiler Inspections which commenced in 1885. At this time, it was on record that there was a 20 hp McNaught engine operating in Henry Clark & Co's sawmill in Collins Street, Hobart; this mill was later bought out by Risby Bros in 1921. Incidentally the first Inspector of Machinery was a Mr John Clark, a brother of Henry Clark. These two brothers had taken over the Engineering business consisting of workshops, foundry and the importation of machinery from their father Alexander Clark upon his retirement in 1870. Alexander Clark, a prominent engineer, arrived in Van Dieman's Land in 1832 and set up his own engineering business in 1838.

In July 1872 'The Engineer' (a leading British Engineering Journal) reported on the manufacture by Mr John Clark of Hobart Town of a boiler for a 20 hp McNaught engine. This was obviously the same engine.

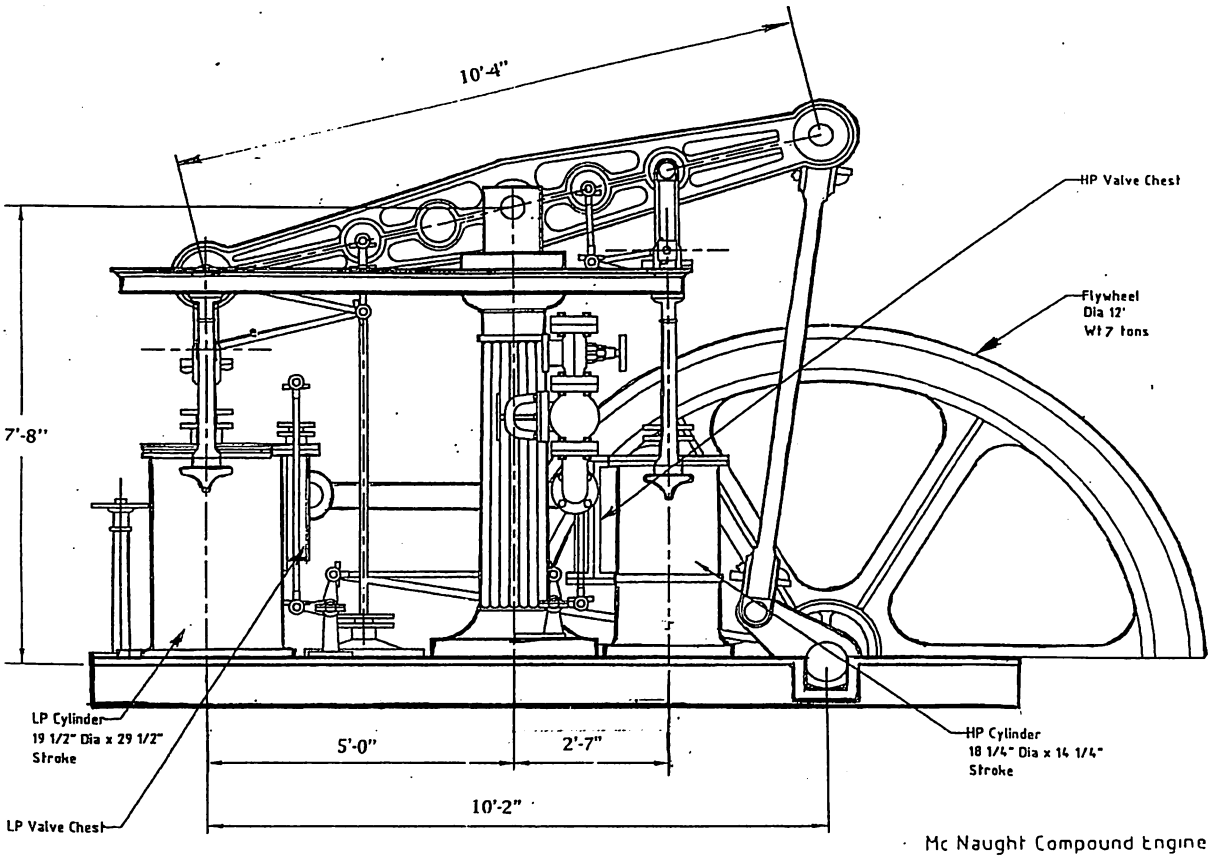

Figure 2: Side Elevation of Engine

Enquiries were made to the successors of A & W Smith & Co viz Fletcher Smith Ltd of Derby and to Archives Offices in Scotland and whilst all were most co-operative, no additional information has been obtained as to the arrival of the engine into the Colony. It is considered most likely that Alexander Clark or his sons imported this engine.

3. THE McNAUGHT PATENT

Up to about the middle of the 19th century most Beam Engines were of the low pressure single cylinder type. By the mid 19th century boiler pressures had increased considerably and in order to obtain additional power from this increase, many existing single cylinder engines were fitted with an additional cylinder mounted alongside the low pressure cylinder.

This frequently resulted in overstressing of the beam and William McNaught had the idea of mounting the additional cylinder on the opposite, or crank side of the central column thus avoiding this overstressing. In 1845 McNaught took out a 15 year patent on the placing of the high pressure cylinder in this position and such engines became known as McNaught or McNaughted (Beam) Engines. This patent applied not only to engines which had been modified by the fitment of a high pressure cylinder, but also those which were originally built with this cylinder configuration (see Figure 2).

4. ENGINEERING DETAILS

The engine, although small by comparison to many Beam Engines made in Britain in the 19th century, has many interesting features.

The most controversial feature is the placement of the high pressure cylinder which necessitated portion of the central column being cut away to make room for the steam line entering the valve chest (see Figure 3). This arrangement results in the whole high pressure cylinder having to be removed in order to gain access to the steam chest and valve. Obviously this was the only possible solution for, if the cylinder was turned through 180° the connecting rod would strike the valve chest. In outward appearance the two double acting cylinders are similar in size, however the lower one third of the high pressure cylinder is in effect a pedestal, whilst only the upper two thirds is the cylinder proper. The lower pedestal section has a cut away portion to provide clearance for the crank shaft and connecting rod (see figure 4). The cylinder dimensions are as follows:-

High Pressure 18" diameter bore x 14.5 stroke
Low Pressure 19.5" diameter bore x 29.5 stroke

Whilst the difference in cylinder bores are minimal, the variation in stroke, due to the relative cylinder positions, results in a cylinder capacity ratio of 2.36:1 (see Figure 2).

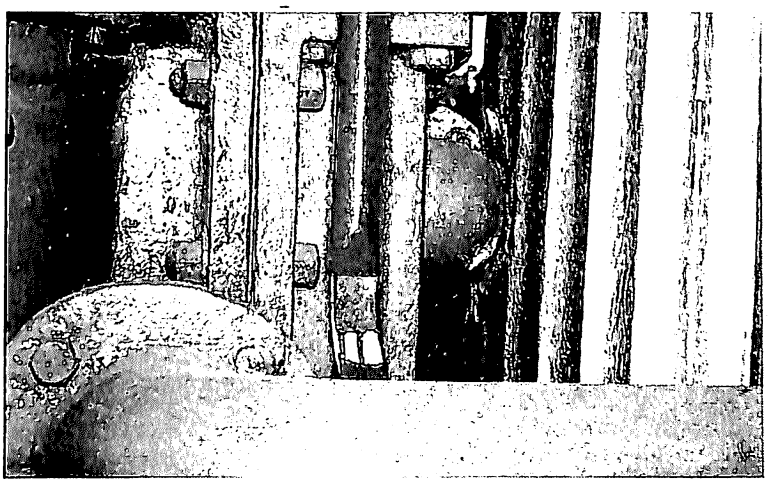

Figure 3: Note Recess Cut Into Central Column

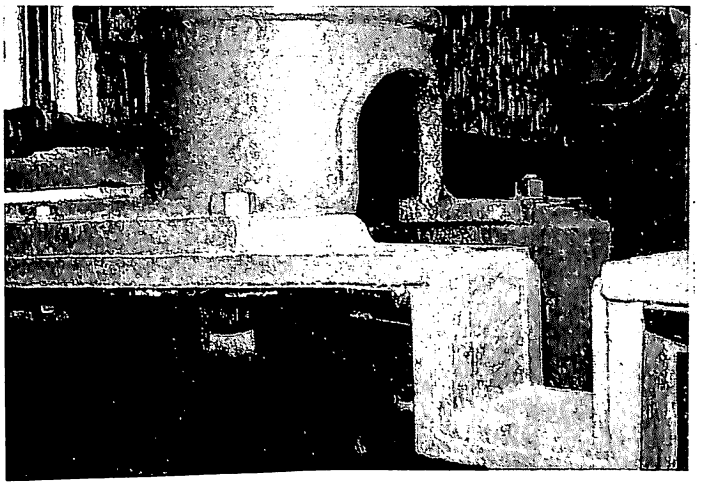

Figure 5: Note Locating Lug Cast into Base Plate

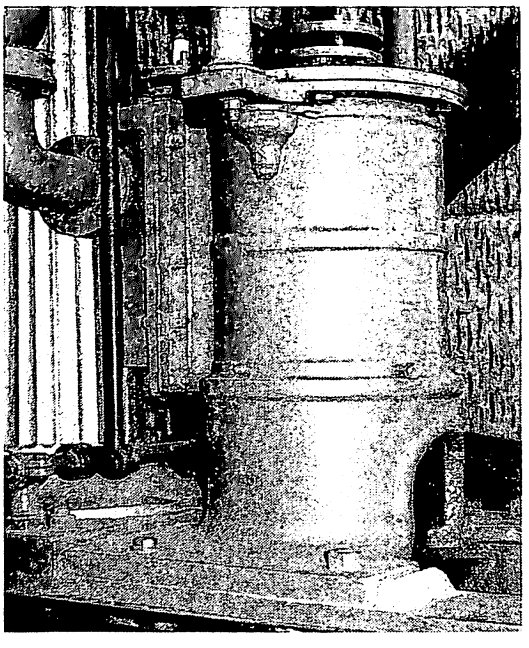

Figure 4: H.P. Cylinder and Support Pedestal

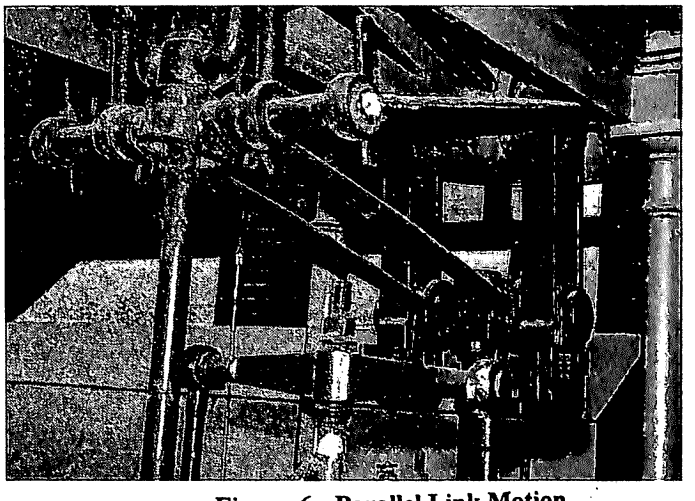

Figure 6: Parallel Link Motion

Initially the foregoing led to the conclusion that the engine had been McNaughted, ie the high pressure cylinder had been added at a later stage, Dr Peter Milner, Senior Lecturer in Mechanical Engineering, University of Melbourne, in his report dated November 1992, considered that the engine was originally built as a compound engine, making use of existing patterns and components. The article appearing in The Engineer of July 1872, which confirmed Dr Milner's findings was discovered well after he published his paper, and examination of the engine base plate further confirmed this opinion (see Figure 5). The engine incorporates the parallel link motion patented by James Watt in 1784 (see Figure 6).

Another notable feature is the way in which the bedplate and valve control linkages and shafts have been built so as to enable the flywheel and drive to be mounted on either side of the engine (see Figure 7).

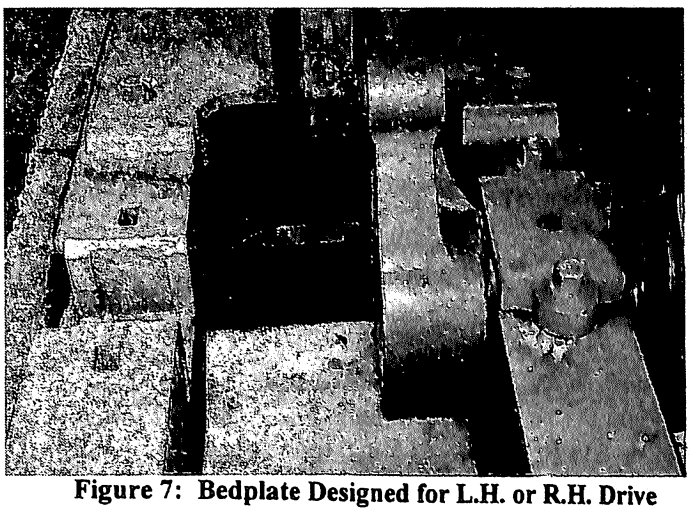

Figure 7: Bedplate Designed for L.H. or R.H. Drive

Other features of interest are the use of artistically tapered columns, both for the central beam supporting column and the minor columns supporting the entablature (see Figure 8). Most moving parts are assembled and held together by the use of tapered keys (see Figure 9).

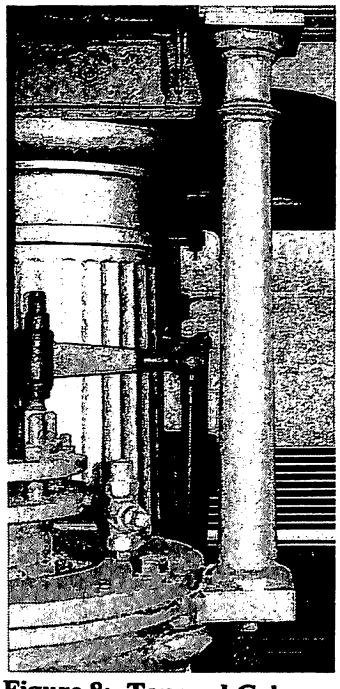

Figure 8: Tapered Columns

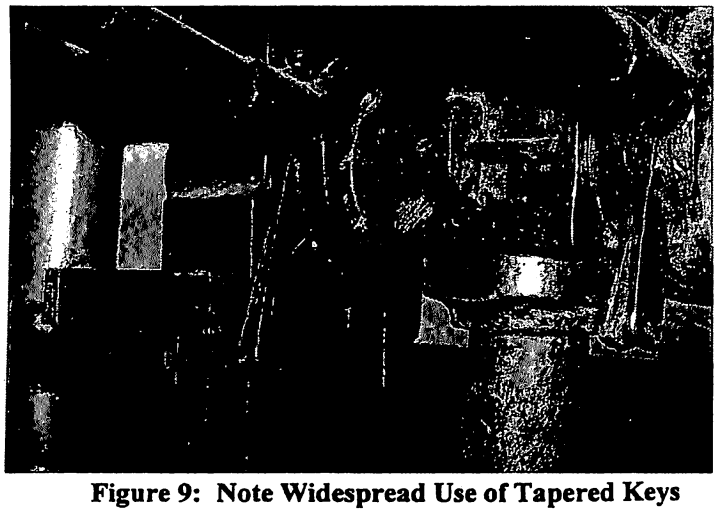

Figure 9: Note Widespread Use of Tapered Keys

The 7½ tonne flywheel is cast in two halves and balanced by some 16 balance weights bolted into recesses in the rim. As is common practice with engines of this type, the hub of the flywheel is bored out considerably larger than the diameter of the crankshaft and secured to the shaft by four flat wedges (see figure 10).

Although the engine was initially operating under a pressure of 40lbs per square inch, in later years it was reported as operating under a pressure of up to 100lbs per square inch.

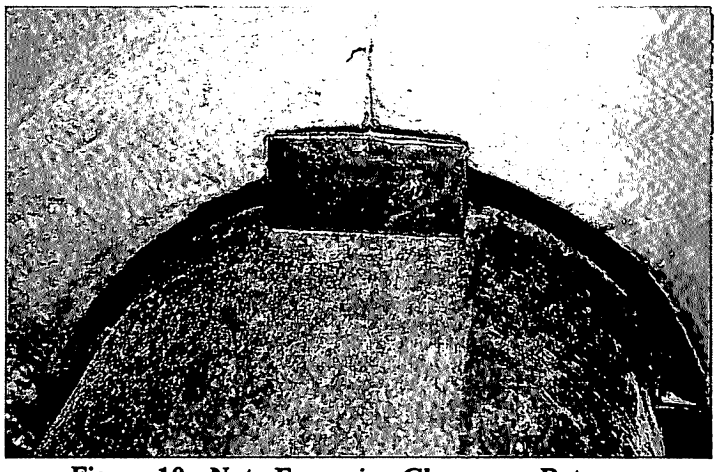

Figure 10: Note Excessive Clearance Between Flywheel and Shaft

The operating pressure of the engine prior to removal in 1955 was 80lbs per square inch at 80/90 rpm.

The only other land based beam engine listed in the boiler inspection records of 1885 was a 15 hp unit of unknown make operating with a pressure of 35lbs per inch at D Ritchie & Sons flour mill in Launceston. The subsequent fate of this engine is unknown.

5. ESTABLISHING THE ENGINE'S CLAIM TO FAME

In October 1992, the Institution of Engineers Australia held the 6th National Engineering Heritage Conference in Hobart and it was most fortuitous that the Keynote Speaker at this Conference was Professor Angus Buchanan, then Director of the Centre for the History of Technology at the University of Bath (UK). He is a recognised world authority on the history of early steam engines and a past president of the Newcomen Society. Dr Peter Milner, was also in attendance at the Conference. Both were impressed with the Historic Importance of the engine and Professor Buchanan later stated in his report on his Australian Tour that ..."at the Technical College there stands a mid-nineteenth century beam engine for which it is likely that a claim could be made that it is the oldest surviving McNaught (Compound) Engine". He further stated ".... It deserves to be moved into a better protected environment".

This claim was further supported by information contained in the publication "The Industrial Archaeology of the Steam Engine", of which Prof Buchanan was co-author and in which it listed the oldest exiting McNaught engine in Britain as having been built in 1865. Dr Milner helped with overseas enquiries and reference has previously been made to his detailed report on the engine.

In May 1994 the Newcomen Society in London, the recognised World Authority on such matters, confirmed that they were unable to find an older McNaught Beam Engine.

Figure 11: Makers Plate Dated 1854

6. CONCLUSION

The Historic Engineering Marker presented by the Institution of Engineers Aust was unveiled by the Hon Sue Napier MHA, Deputy Premier and Minister for Education and Vocational Training in the Boardroom of the Hobart Institute of TAFE on Tuesday, 8th April 1997. The function was arranged jointly by the Institution and the Institute.

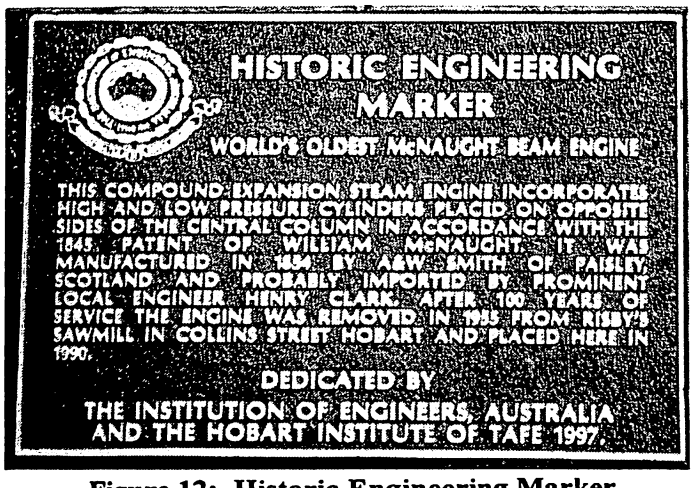

Figure 12: Historic Engineering Marker

Mr C A Risby, former Managing Director of Risby Forest Industries, who gifted the engine to the Government some 42 years earlier and who recently donated most of the cost of protective roofing over the engine, also participated in the ceremony.

At the same time it was announced that the Tasmanian Museum and Art Gallery had agreed to accept formal ownership of the engine, thus ensuring its long term safe keeping.

As a person who has had close involvement with the engine from the time of its removal from Risbys Mill in 1955, I consider the final outcome for the Engine's Preservation to be most satisfying; it is however, fair to say that without the visit made to Hobart in order to attend the 1992 Engineering Heritage Conference and interest shown by both Professor Buchanan and Dr Milner, the engine would have remained just an interesting old engine and would certainly not have received World Recognition.

7. ACKNOWLEDGEMENTS

The Author wishes to record his appreciation for the interest and research carried out over several years by Dr Peter Milner, Senior Lecturer in Mechanical Engineering, University of Melbourne and to the assistance given by Mr Clive Ellam, Executive Secretary of the Newcomen Society of London.

8. REFERENCES

(i) R A Buchanan, OZ92 Reflections on the Australian Engineering Heritage 1992.

(ii) R A Buchanan & G Watkins, The Industrial Archaeology of the Stationary Steam Engine London, Lane 1976.

(iii) P Milner, A McNaughted Beam Engine in Hobart, Technology Note No TN 92/35 November 1992.